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DOCUMENT-IDENTIFIER: US 6473030 B1
TITLE: Infrastructure-aiding for satellite navigation receiver and method

Brief Summary Text (5):
Each one of the constellation of GPS satellites in orbit about the earth transmits one of thirty-two unique identifying codes in a code-division multiple access (CDMA) arrangement. Such allows all of the many GPS satellites to transmit in spread spectrum mode at the same frequency, plus or minus a Doppler frequency shift of that frequency as results from the satellite's relative velocity. Particular satellites are sorted out of a resulting jumble of signals and noise by correlating a 1023 "chip" code to one of the thirty-two pseudo random number (PRN) sequence codes that are preassigned to individual GPS satellites. These codes are not necessarily being transmitted in phase with one another. Therefore, "finding" a GPS satellite initially involves searching various carrier frequencies, to account for Doppler frequency shift and local crystal oscillator inaccuracies. The searching also needs to find a code match, using 1023 different code phases and twenty or more possible correlation code templates.

Detailed Description Text (7):
The corrective frequency offset of the cell-phone carrier-frequency synthesizer loop can be used to estimate the GPS receiver frequency offset. Such estimate is used to reduce the frequency uncertainty and thus reduce the time-to-first-fix, improve receiver sensitivity, and/or reduce the size and power-consumption of the hardware. Digital numeric-controlled oscillator (NCO) and analog voltage-controlled oscillator (VCO) are both commonly used in such carrier-frequency synthesizer loops.

Detailed Description Text (224):
An estimate of the drift can be formed by assuming that the cell-phone is static, so that the rangeRateCP term can be assumed to be zero. The accuracy of the estimate is driven by the accuracy of this assumption. However, for most low cost clocks, the frequency uncertainty caused by temperature and aging on the crystal are much larger than the user dynamics between the cell-phone and cell-site, and the estimate provides a huge information gain that can be used to reduce search time and or increase sensitivity.

Detailed Description Text (254):
where: C4=1 C5=driftSVhat (from the satellite ephemeris) C6=1/(.lambda.GR) (.lambda.-GR)=C/baseGRfreq

Detailed Description Text (365):
Actually, one can compute the cell-phone position without any GPS satellite tracked at the cell-phone. Because the cell-sites do significant relative vertical displacement, the three-dimensional solution is very noisy. However, a two-dimensional solution is possible if altitude of the cell-phone is available. (Remember, the GPS satellites are still needed at the cell-sites for synchronizing the cell-sites.) A three-dimensional-CDMA-only is also possible if the cell-sites have good vertical separation.

Detailed Description Text (368):
In operation, the GPS receiver 112 must simultaneously search for GPS-microwave signals in two domains, e.g., frequency and code-phase. The local oscillator and Doppler shift caused by satellite vehicle relative velocity create carrier frequency

uncertainties that are resolved. The instantaneous GPS-satellite pseudo-random number (pseudo-random number) code phase is another unknown. Received signals that are above the "noise floor" are relatively easy and quick to search. But weak signals, as exist inside buildings, are buried in as much as twenty decibels of noise. Each visit to a frequency/code-phase bin must dwell there long enough to "beat down" the noise floor with processing gains provided by code correlators. Weak signals also require that the search bins have finer steps between bin frequencies and bin code-phase, e.g., due to aliasing. So more bins are needed to be searched and each bin needs more processing dwell, all of which increases search time exponentially.

Detailed Description Text (381):
The corrective frequency offset of the cell-phone carrier-frequency synthesizer loop is again used here in this embodiment to estimate the GPS receiver frequency offset. Such estimate is used to reduce the frequency uncertainty and thus reduce the time-to-first-fix, improve receiver sensitivity, and/or reduce the size and power-consumption of the hardware. Digital numeric-controlled oscillator (NCO) and analog voltage-controlled oscillator (VCO) are both commonly used in such carrier-frequency synthesizer loops.

CLAIMS:

3. The system of claim 1, wherein: the webserver provides information to the first satellite-navigation receiver that reduces at least one of local-oscillator frequency uncertainty and time uncertainty, and provides for improved satellite search times and sensitivity.

8. The system of claim 6, wherein: the webserver provides information to the first satellite-navigation receiver that reduces at least one of local-oscillator frequency uncertainty and time uncertainty, and provides for improved satellite search times and sensitivity.